



Nucleo 5 WiFi Module

Version V 1.0

Datasheet

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0. Version History

Version	ECN#	Date	Notes	Revised By	Verified By
V1.0	-	03-11-22	Initial Release Version	Ankit K.	Shashank S.

1. Introduction

Nucleo 5 is a Wi-Fi and BLE module developed by IoTfy Solutions Private Limited. The core processor of the module, ESP32-C3 from Espressif Systems, is a Wi-Fi+ BLE combination of system-level chips (SoC). Nucleo 5 is suitable for various applications such as internet of things (IoT), mobile devices, and wearable electronics.

ESP32-C3 with industry-leading low power and RF performance, supporting Wi-Fi IEEE 802.11 b/g/n agreements and BLE 5.0. ESP32-C3 chip is equipped with a 32-bit RISC-V single-core processor, operating frequency up to 160 MHz. The chip is supported to have secondary development without using other microcontrollers or processors. The chip has a built-in 400 KB SRAM, 384 KB ROM, 8KB RTC SRAM. Also, the chip supports external Flash while its built-in 4Mbit Flash.

ESP32-C3 chip supports a variety of low-power consumption working states, which can meet the power consumption requirements of various application scenarios. The chip's unique features such as fine clock gating function, dynamic voltage clock frequency adjustment function, and RF output power adjustable function can achieve the best balance between communication distance, communication speed and power consumption.

Nucleo 5 provides a wealth of peripheral interfaces, including UART, PWM, SPI, I2S, I2C, ADC, temperature sensor and there are 15 GPIOs.

Nucleo 5 has a variety of unique hardware safety mechanisms. The hardware encryption accelerator supports AES, SHA and RSA algorithms. Among them, RNG, HMAC and Digital Signature modules provide more security features. Other security features include flash encryption and secure boot signature verification, etc. The perfect security mechanism enables the chip to be perfectly applied to various encryption products.

Nucleo 5 module supports low-power Bluetooth:Bluetooth5 and Bluetooth mesh. Bluetooth rate support: 125Kbps, 500Kbps, 1Mbps, 2Mbps. Support broadcast extension, multi-broadcasting, channel selection.

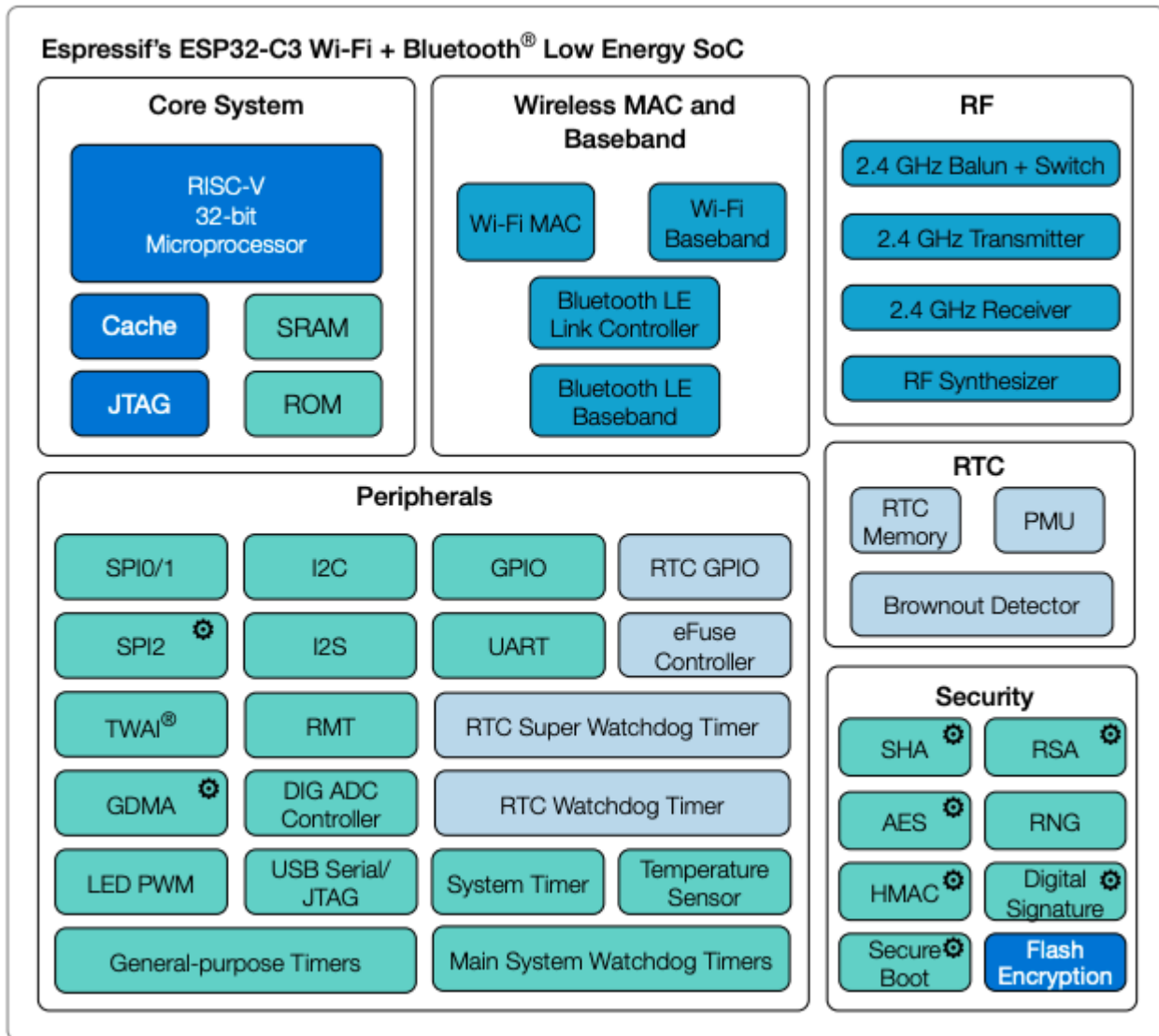


Figure 1: ESP32-C3 Architecture (Source: Espressif)

1.1. Features

- Complete 802.11b/g/n WiFi SoC module, 1T1R mode data rate up to 150Mbps
- Support BLE5.0 and rate support : 125Kbps, 500Kbps, 1Mbps,2Mbps
- 32-bit RISC-V single-core processor, supports a clock frequency of up to 160MHz, with 400 KB SRAM, 384 KB ROM, 8KB RTC SRAM
- Built-in Flash
- Support UART/PWM/GPIO/ADC/I2C/I2S interface, temperature sensor, pulse counter
- SMD-22 package
- Support multiple sleep modes, deep sleep electric current is less than 5uA
- UART rate up to 5Mbps
- Supports STA/AP/STA+AP and mix mode
- Smart Config support for Android and IOS
- Supports serial local upgrade and remote firmware upgrade (FOTA)
- General AT command can get started quickly
- Supports secondary development, integrated Windows, Linux development environment

1.2. Specification

Model name	Nucleo 5
Package	SMD-22
Size	16*24*2.8(±0.2)mm
SPI Flash	4MB Flash
Interface	UART/GPIO/ADC/PWM/I2C/I2S
IO ports	15
UART Baud Rate	Support 110 ~ 4608000 bps, Default 115200 bps
Frequency range	2400 ~ 2483.5MHz
Antenna	PCB antenna
Bluetooth	BLE 5.0
WiFi Security Modes	WEP/WPA-PSK/WPA2-PSK
Power supply	Voltage 3.0V ~ 3.6V, Current >500mA
Working temperature	-40°C ~ 85°C
Storage temperature	-40°C ~ 105°C, < 90% RH

2. Pin Definition

Nucleo 5 module has the following pin outs.

2.1. Pin diagram

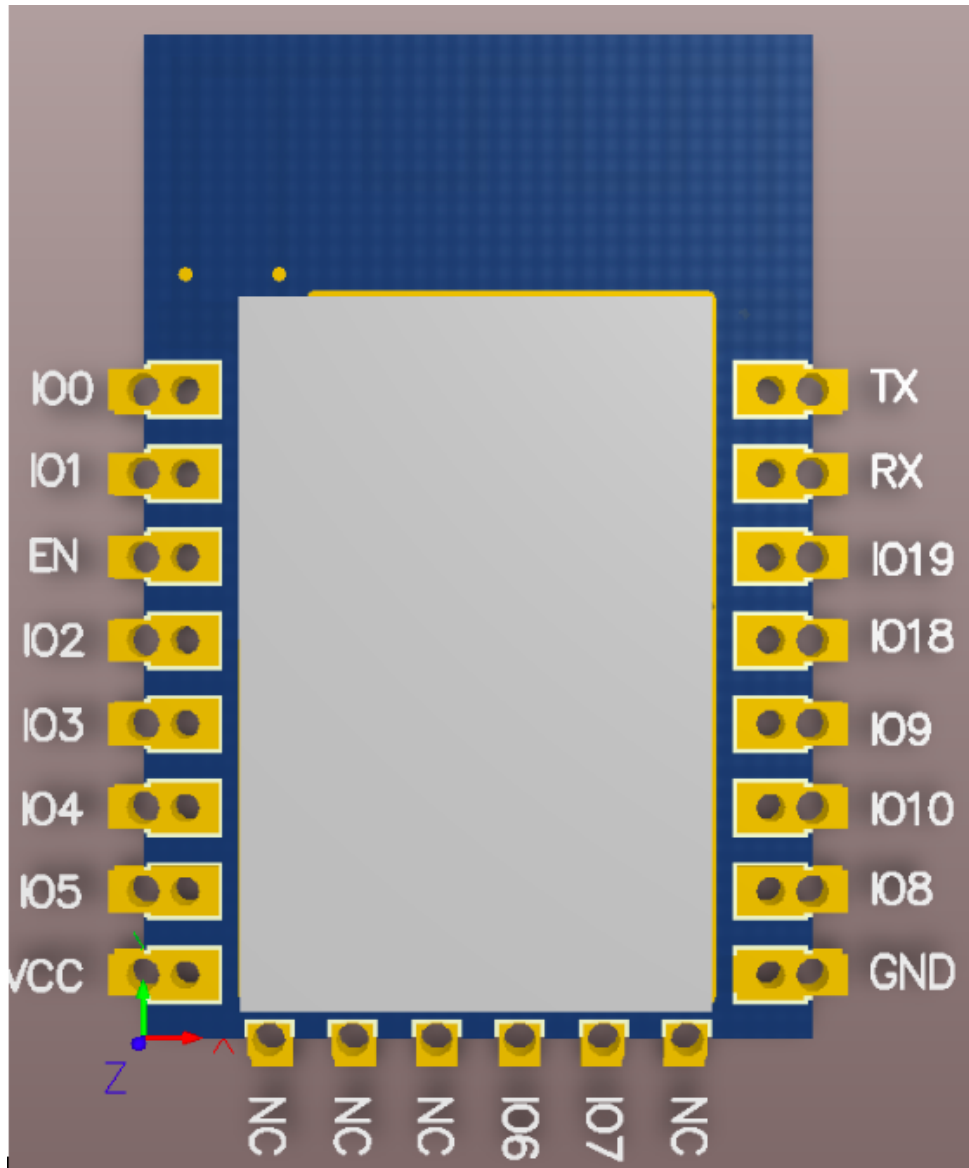


Figure 2: Pinouts of Nucleo 5

2.2. Pin function definition

Pin No.	IO	Function description
1	IO0	GPIO0,ADC1_CH0,XTAL_32K_P
2	IO1	GPIO1,ADC1_CH1,XTAL_32K_N
3	EN	High level: chip enabled; Low level: chip shutdown; Do not to leave the CHIP_PU pin floating
4	IO2	GPIO2,ADC1_CH2,FSPIQ
5	IO3	GPIO03,ADC1_CH3
6	IO4	GPIO04,ADC1_CH4,FSPIHD,MTMS
7	IO5	GPIO05,ADC2_CH0,FSPIWP,MTDI
8	VCC	VCC
9	NC	NC
10	NC	NC
11	NC	NC
12	IO6	GPIO6,FSPICLK,MTCK
13	IO7	GPIO7,FSPID,MTDO
14	NC	NC
15	GND	GND
16	IO8	GPIO8
17	IO10	GPIO10,FSPICSO
18	IO9	GPIO9
19	IO18	GPIO18

20	IO19	GPIO19
21	RX	UART0_RX,GPIO20
22	TX	UART0_TX,GPIO21

Module startup mode description

Pin	Default	SPI Start up mode	DownloadStart upMode
IO8	High	NON	High
IO9	High	High	LOW

Note: Some pins have been pulled up or pulled down internally, please refer to the schematic diagram

3. Electrical Parameters

3.1. Electrical Characteristics

Parameter	Condition	Min	Typical	Max	Unit	
Maximum soldering temperature	IPC/JEDEC J-STD-020	-	-	260	°C	
Voltage	V_{DD}	3.0	3.3	3.6	V	
I/O	V_{IL}/V_{IH}	-	-0.3/0.75 V_{IO}	-	0.25 V_{DD} /3.6	V
	V_{OL}/V_{OH}	-	N/0.8 V_{IO}	-	0.1 V_{IO} /N	V
	I_{MAX}	-	-	-	12	mA

3.2. WiFi RF performance

Description	Typical	Unit
Frequency	2400 - 2484	MHz
Output power		
PA output power in 11n mode	15±2	dBm
PA output power in 11g mode	16±2	dBm
PA output power in 11b mode	18±2	dBm
Receiving sensitivity		
CCK, 1 Mbps	-96±3	dBm
CCK, 11 Mbps	-88±3	dBm
6 Mbps (1/2 BPSK)	-92±3	dBm
54 Mbps (3/4 64-QAM)	-75±3	dBm
HT20 (MCS7)	-73±3	dBm
HT40 (MCS7)	-70±3	dBm

3.3. BLE RF Performance

Description	Typical	Unit
Output power		
Transmit Power	0±2	dBm
Receiving sensitivity. Low Energy Consumption BLE : 1M		
Sensitivity@30.8%PER	-96±2	dBm

3.4. Power consumption

The following power consumption figures are based on a 3.3V power supply, 25 °C ambient temperature, and measured using an internal voltage regulator.

- All measurements are performed at the antenna interface without a SAW filter.
- All transmission data is measured based on 100% duty cycle in continuous transmission mode.

Mode	Min	Typical	Max	Unit
Tx 802.11b, CCK 11Mbps, P _{OUT} =+20dBm	-	345	-	mA
Tx 802.11g, OFDM 54Mbps, P _{OUT} =+18dBm	-	285	-	mA
Tx 802.11n, MCS7, P _{OUT} =+17dBm	-	280	-	mA
Rx 802.11b, packet length is 1024 bytes	-	81	-	mA
Rx 802.11g, packet length is 1024 bytes	-	81	-	mA
Rx 802.11n, packet length is 1024 bytes	-	84	-	mA
Modem-Sleep	-	20	-	mA
Light-Sleep	-	130	-	µA
Deep-Sleep	-	5	-	µA
Power Off	-	1	-	µA

4. Dimensions

All dimensions are in mm. Tolerance $\pm 0.2\text{mm}$

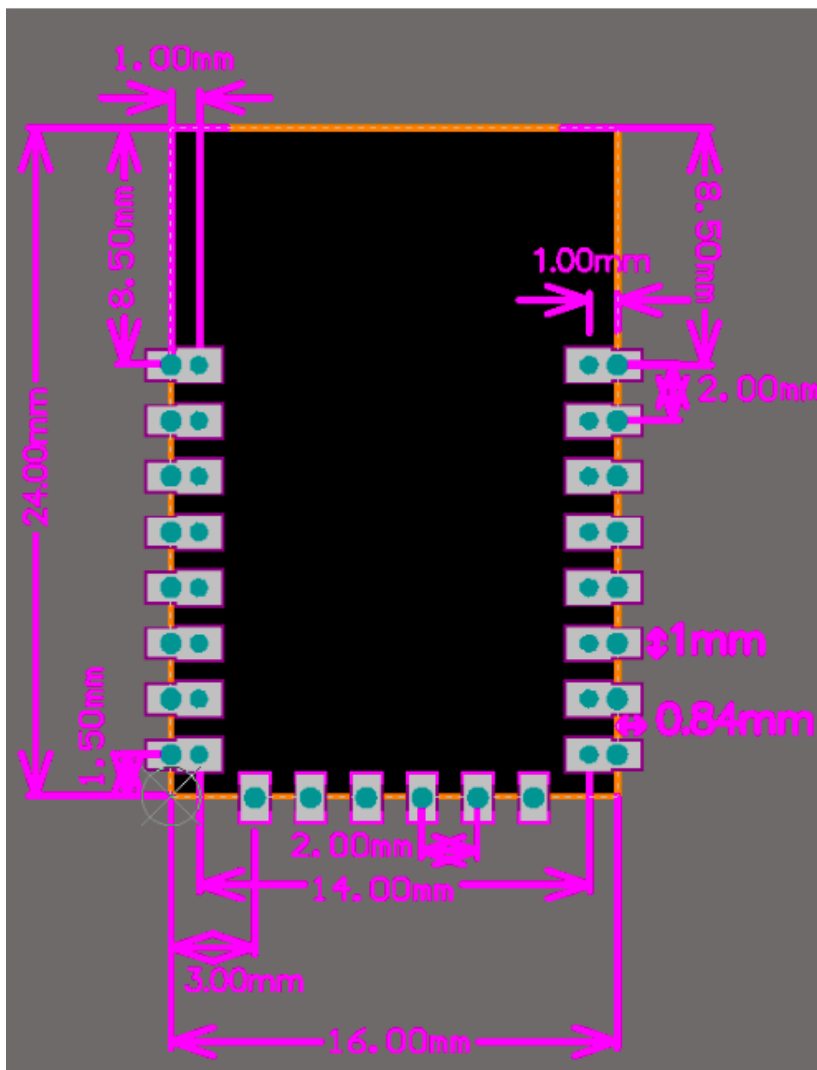


Figure 3: Dimensions of Nucleo 5

5. Schematic

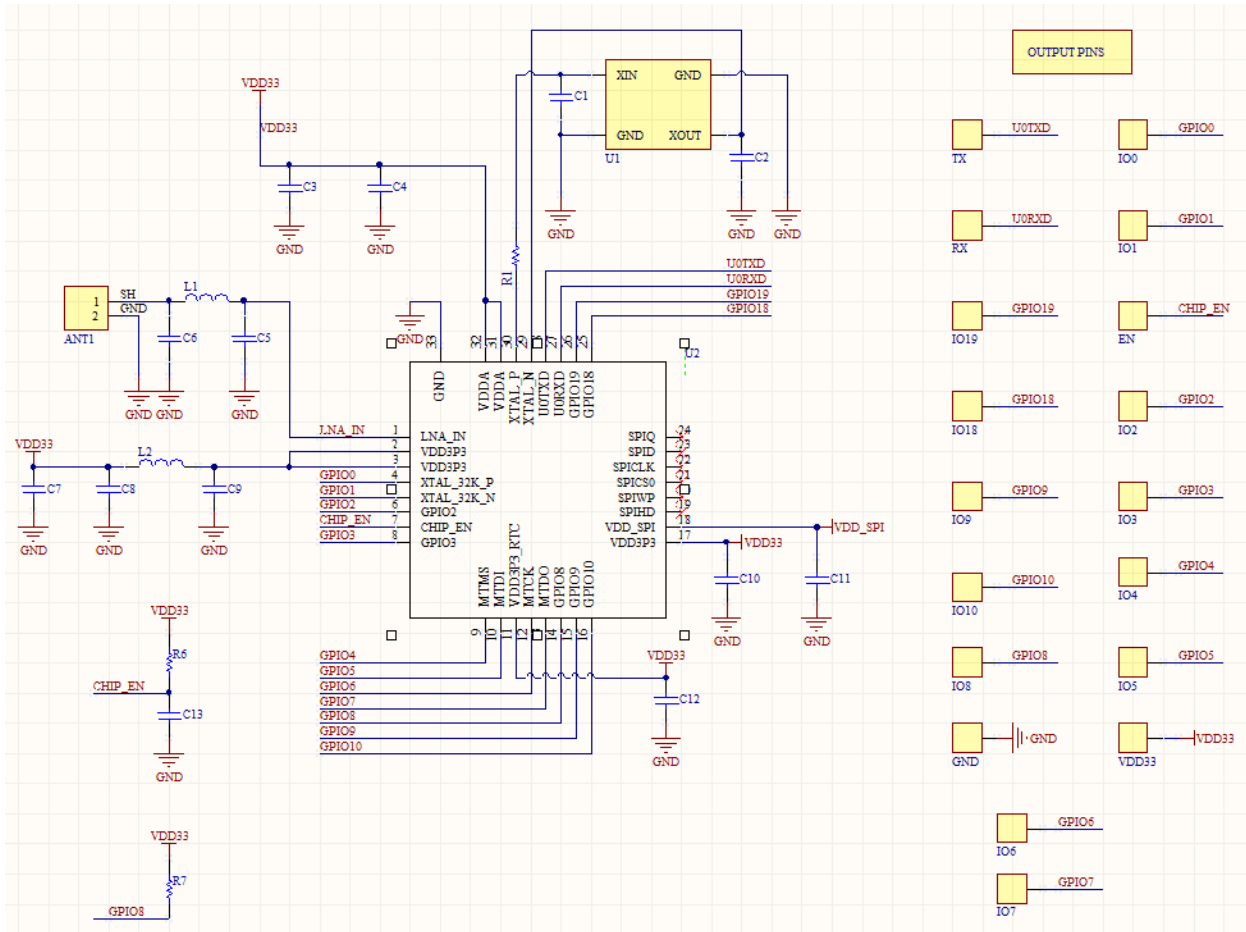


Figure 4: Schematics of Nucleo 5 Module

5.1. Antenna Layout Requirements

For the installation position on the PCB, the following two methods are recommended:

Solution 1: Place the module on the edge of the motherboard, and the antenna area extends beyond the edge of the motherboard.

Solution 2: Place the module on the edge of the motherboard, and the edge of the motherboard hollows out an area at the antenna position.

In order to meet the performance of the on-board antenna, it is forbidden to place metal parts around the antenna and keep it away from high-frequency devices.

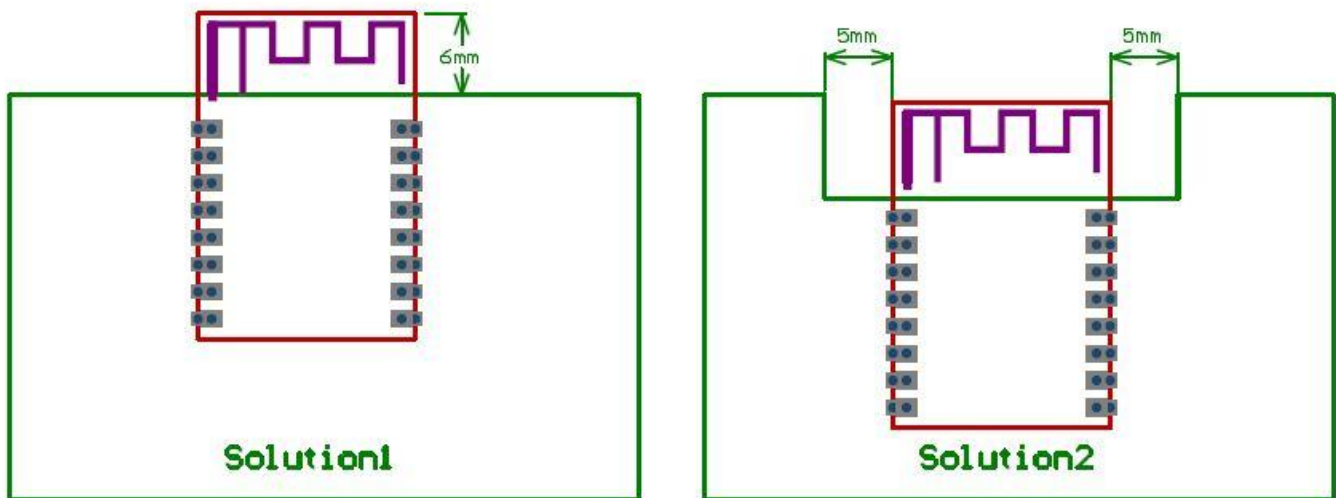


Figure 6: Recommended Installation Positions

5.2. Power supply

- Recommended 3.3V voltage, peak current above 500mA
- It is recommended to use LDO power supply; if using DC-DC, it is recommended to control the ripple within 30mV.
- The DC-DC power supply circuit is recommended to reserve the position of the dynamic response capacitor, which can optimize the output ripple when the load changes greatly.
- 3.3V power interface is recommended to add ESD devices.

5.3. Use of GPIO ports

Some GPIO ports are led out of the module. If you need to use a 10-100 ohm resistor in series with the IO port. This can suppress overshoot, and the levels on both sides are more stable. This helps in both EMI and ESD.

The special IO port is pulled up and down, please refer to the instruction manual of the specification, this will affect the startup configuration of the module.

The IO port of the module is 3.3V. If the IO level of the main control and the module does not match, a level conversion circuit needs to be added.

If the IO port is directly connected to a peripheral interface, or a pin or other terminal, it is recommended to reserve an ESD device near the terminal of the IO trace.

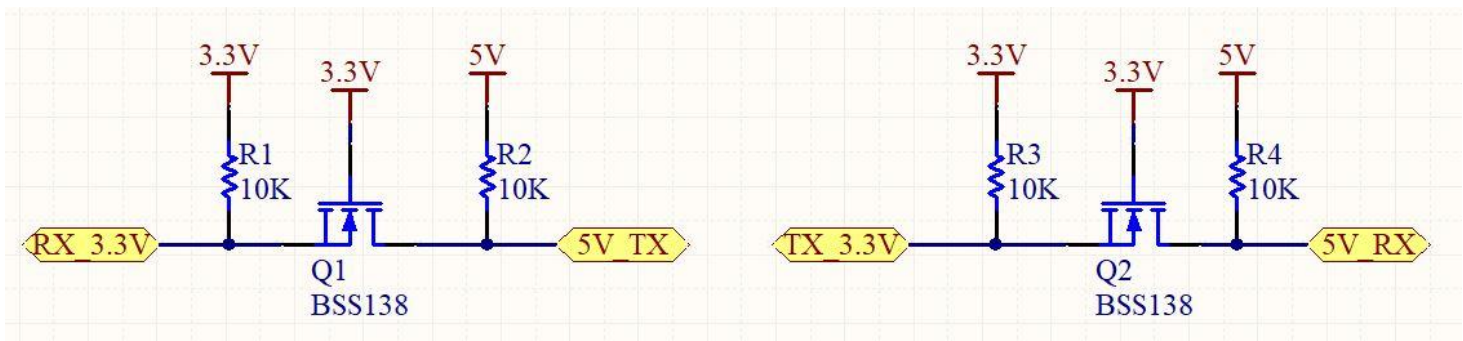


Figure 7: Reference Level Shifting Circuit

6. Reflow Profile

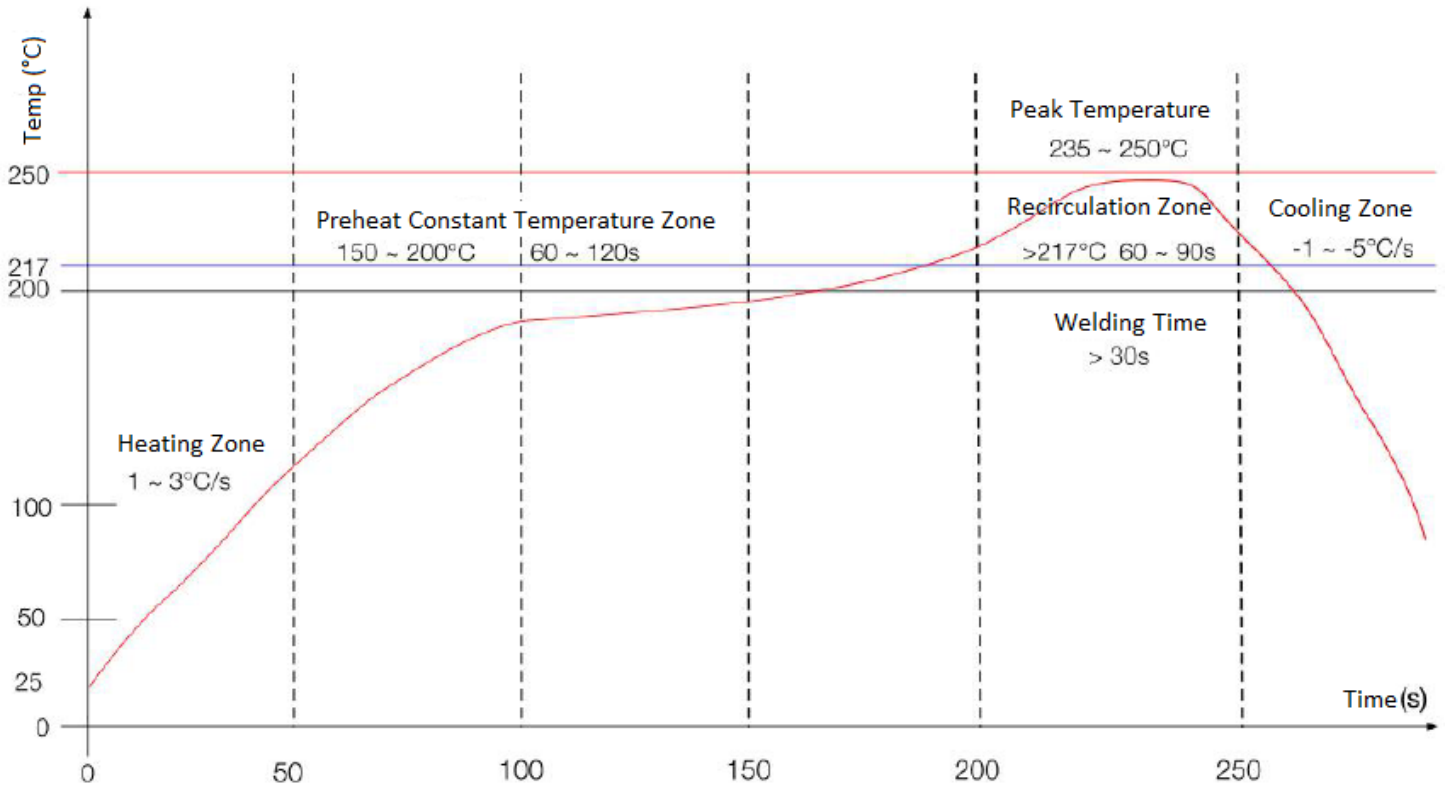


Figure 8: Reflow Profile

Heating Zone	Temperature: 25~150°C	Time: 60-90 sec	Heating Slope: 1-3°C/sec
Preheating Constant Temperature Zone	Temperature: 150~200°C	Time: 60-120 sec	
Reflow Soldering Zone	Temperature>217°C Peak Temp: 235~250°C	Time: 60-120 sec Time:30~70 sec	
Cooling Zone	Peak Temp: 180°C	Cooling Slope: -5°C/sec	

7. Packaging

The packaging of Nucleo 5 is in tray form.

8. Contact Us

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